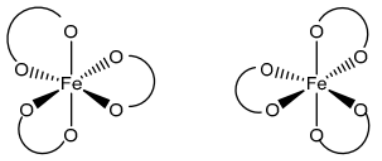
28. Chemistry of transition elements

28.4 Stereoisomerism in transition element complexes

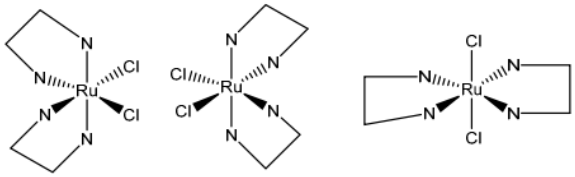
Paper 4

Marking Scheme

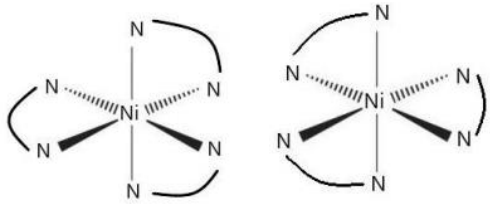
Q1.

(e)		2

Q2.

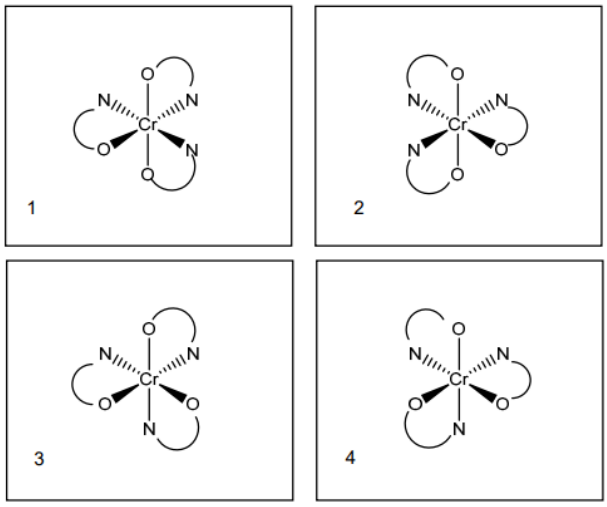
(e)(i)		3
(e)(ii)	optical **AND** cis-trans / geometical	1

Q3.

(c)	 octahedral with correct 3D for one $[Ni(en)_3]^{2+}$ [1] second optical isomer [1] optical isomerism [1]	3

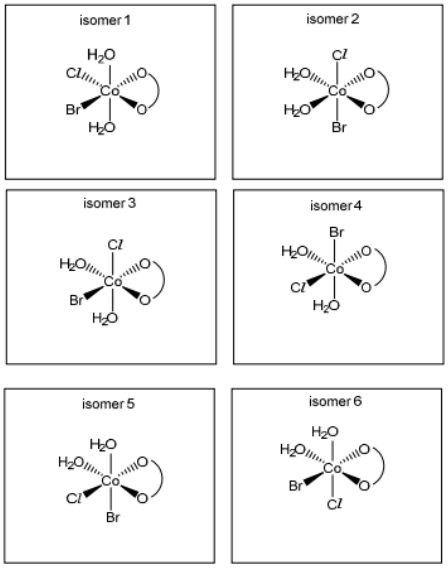
Q4.

(a)	geometrical / cis-trans **AND** optical	**1**

(c)	 Two correct for one mark, three correct for two marks, four correct for three marks.	**3**

Q5.

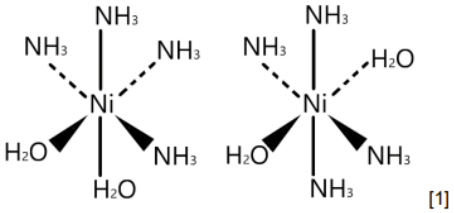
(c)(i)	**M1** (a species) that donates / uses two lone pairs **M2** to form a two dative / coordinate bond to a metal atom / metal ion	**2**

(c)(ii)	*Any four from:*  Any two [1], any three [2], all four [3]	**3**
(c)(iii)	oxidation state of cobalt (+)3 **AND** type of stereoisomerism cis-trans **OR** geometric(al) **OR** optical	**1**

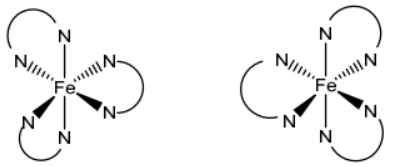
Q6.

(b)(i)	trans = non-polar cis isomer 1 = polar cis isomer 2 = polar ALL [1]	1
(b)(ii)	optical isomers / non-superimposable mirror images [1] ALLOW enantiomers / they rotate polarised light differently	1

Q7.

(b)(v)	$[Rh(en)_2Cl_2]^+$ **AND** optical **AND** cis / trans **OR** geometric [1]	1
(b)(vi)	 [1] cis/trans **OR** geometric [1]	2

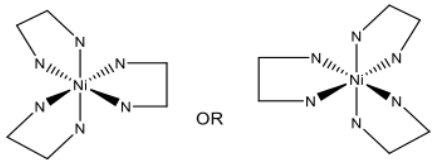
Q8.

(b)(ii)	 **M1** one correct 3D diagram with three bipy ligands **M2** both diagrams correct **M3** optical isomerism	3

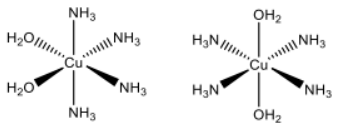
Q9.

(e)	 **M1** one correct 3D diagram with the six correct ligands **M2** both 3D diagrams correct	2

Q10.

(b)(ii)	 OR	1
(b)(iii)	octahedral **AND** optical isomerism	1

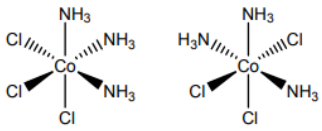
Q11.

(b)(i)	 cis and trans drawn	1
(b)(ii)	***cis*** *identified* as **polar AND** ***trans*** *identified* as **non-polar** *conditional on diagram*	1

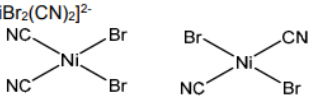
Q12.

(c)(i)	forms 2 dative / coordinate bonds	1
(c)(ii)	one isomer correct with correct 3D [1] three isomers different with correct 3D [1]	2
(c)(iii)	e.g. 1 and 2 optical [1] e.g. 1 or 2 and 3 cis-trans / geometric [1]	2

Q13.

(c)	 geometric **ALLOW** cis-trans Two correct responses = 1 mark Three correct responses = 2 marks	2

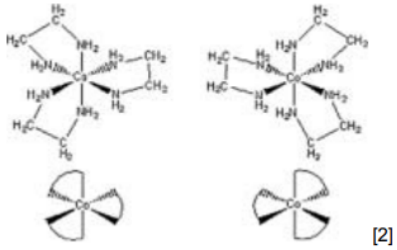
Q14.

(d)	**M1** two correct structures cis & trans for $[NiBr_2(CN)_2]^{2-}$  **M2** type of stereoisomerism: cis-trans/geometric	**2**

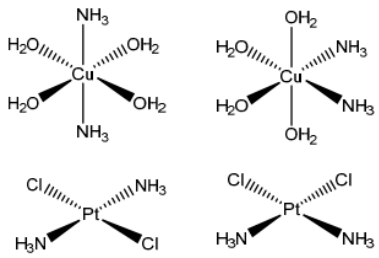
Q15.

(c)(i)	 both correct [1]	**1**
(c)(ii)	**square planar** [1]	**1**

Q16.

(d)(ii)	 [2]	**2**
(d)(iii)	optical [1]	**1**

Q17.

(e)(i)	cis-trans isomerism [1] **ALLOW** geometric(al)	**1**
(e)(ii)	 one correct pair [1] two correct pairs [2]	**2**